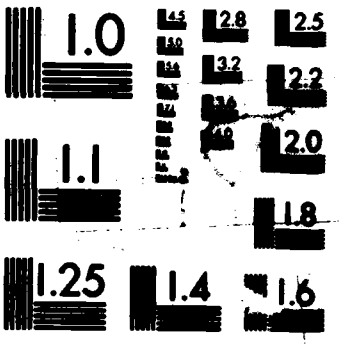
AD-A187 497 AIR TRAFFIC CONTROLLER TRAINEE SELECTION(U) AIR FORCE 1/1
HUMAN RESOURCES LAB BROOKS AFB TX P STOKER ET AL
OCT 87 AFHRL-TP-87-19

UNCLASSIFIED F/G 5/9 NL



AFHRL-TP-87-19

12

AIR FORCE HUMAN RESOURCES LABORATORY

AIR TRAFFIC CONTROLLER TRAINEE SELECTION

Peter Stoker
David R. Hunter
Cheryl L. Batchelor
Linda T. Curran

MANPOWER AND PERSONNEL DIVISION
Brooks Air Force Base, Texas 78235-5601

October 1987
Final Technical Paper for Period December 1978 - October 1985

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5601

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The Public Affairs Office has reviewed this paper, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This paper has been reviewed and is approved for publication.

WILLIAM E. ALLEY, Technical Director
Manpower and Personnel Division

RONALD L. KERCHNER, Colonel, USAF
Chief, Manpower and Personnel Division

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

AD-A187 497

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188

1a REPORT SECURITY CLASSIFICATION Unclassified	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
2b DECLASSIFICATION/DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S) AFHRL-TP-87-19	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a NAME OF PERFORMING ORGANIZATION Manpower and Personnel Division 6b OFFICE SYMBOL (If applicable) AFHRL/MOAE	7a NAME OF MONITORING ORGANIZATION
6c ADDRESS (City, State, and ZIP Code) Air Force Human Resources Laboratory Brooks Air Force Base, Texas 78235-5601	7b ADDRESS (City, State, and ZIP Code)
8a NAME OF FUNDING/SPONSORING ORGANIZATION Air Force Human Resources Laboratory 8b OFFICE SYMBOL (If applicable) HQ AFHRL	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c ADDRESS (City, State, and ZIP Code) Brooks Air Force Base, Texas 78235-5601	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO: 62703F; PROJECT NO: 7719; TASK NO: 18; WORK UNIT ACCESSION NO: 11 & 46

11 TITLE (Include Security Classification)
Air Traffic Controller Trainee Selection

12 PERSONAL AUTHOR(S)
Stoker, P.; Hunter, D.R.; Batchelor, C.L.; Curran, L.T.

13a TYPE OF REPORT	13b TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM Dec 78 TO Oct 85	October 1987	18

16 SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	air traffic controller selection Armed Services Vocational Aptitude Battery (ASVAB) attrition (Continued)
05	09		
05	08		

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

The purpose of this effort was to examine new and existing selection procedures for entry into Air Traffic Control Operator School, in an effort to reduce the high level of attrition during and after training. The existing selection measures were the General Aptitude Index (AI) and Administrative AI from the Armed Services Vocational Aptitude Battery (ASVAB). New tests that were examined included the Multiplex Controller Aptitude Test (MCAT), Object Completion Test (OCT), Rotated Blocks Test (RBT), Perceptual Abilities Test (PAT), and Electrical Maze Test (EMT). First, the relationships between ASVAB AIs and training performance were assessed. It was found that the Administrative AI had a smaller relationship with training performance compared to the General, Mechanical, and Electronics AIs which correlated well with the criteria. Second, the five new tests were administered and the test scores were compared to a dichotomous pass/fail criterion. Multiple regression analyses showed that the combination of MCAT and RBT yielded the best combined prediction and that their use would improve upon prediction made by using the ASVAB alone. In conclusion, the results of this investigation indicated that the General AI is a useful predictor of air traffic controller training performance and that the

20 DISTRIBUTION AVAILABILITY OF ABSTRACT	21 ABSTRACT SECURITY CLASSIFICATION	
[x] UNCLASSIFIED UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS		
22a NAME OF RESPONSIBLE INDIVIDUAL Nancy J. Allin, Chief, STINFO Office	22b TELEPHONE (Include Area Code) (512) 536-3877	22c OFFICE SYMBOL AFHRL/TSR

DD Form 1473, JUN 86 *Previous editions are obsolete*

SECURITY CLASSIFICATION OF THIS PAGE

Unclassified

Item 18 (Concluded):

Multiplex Controller Aptitude Test
selection

Item 19 (Concluded):

Administrative AI should be deleted as a selection requirement for entry into Air Traffic Control Operator School. Further, other tests, not included in the ASVAB, could make a significant contribution to the prediction of air traffic controller training outcomes.

AFHRL Technical Paper 87-19 October 1987

AIR TRAFFIC CONTROLLER TRAINEE SELECTION

Peter Stoker
David R. Hunter
Cheryl L. Batchelor
Linda T. Curran

MANPOWER AND PERSONNEL DIVISION
Brooks Air Force Base, Texas 78235-5601

Reviewed by and submitted for publication by

Lonnie D. Valentine, Jr.
Chief, Force Acquisition Branch

This publication is primarily a working paper. It is published solely to document work performed.

SUMMARY

The objective of this effort was the development of an improved method for the selection of first-term personnel for entry into air traffic controller training.

Rising attrition levels during both training and initial assignments led the Air Force Communications Command to issue a Request for Personnel Research to reevaluate existing selection measures and develop new measures, if needed. At that time, the General Aptitude Index (AI) and Administrative AI from the Armed Services Vocational Aptitude Battery (ASVAB) were used for selection.

First, the relationships between ASVAB AIs and training performance were assessed. In several independent samples, with a total of over 3,000 subjects, it was found that the General AI, Mechanical AI, and Electronics AI correlated well with training performance, whereas the Administrative AI had a smaller relationship with the criteria. On the basis of these analyses, the Air Force Human Resources Laboratory recommended the deletion of the Administrative AI as a selector for entry into air traffic controller training. That recommendation was accepted and the use of the Administrative AI was discontinued.

In addition, five tests were selected for experimental validation: (a) Multiplex Controller Aptitude Test (MCAT), (b) Object Completion Test (OCT), (c) Rotated Blocks Test (RBT), (d) Perceptual Abilities Test (PAT), and (e) Electrical Maze Test (EMT). These five tests were administered to 457 air traffic controller candidates prior to the start of training. Test scores were compared to a dichotomous training criterion--pass versus failure in training. All tests, except the PAT, were significantly correlated with the pass versus fail criterion. The MCAT was the best single predictor. Multiple regression analyses showed that the combination of MCAT and RBT yielded the best combined prediction, and that their use would improve upon prediction made by using the ASVAB alone.

When evaluated against first-year job success/attrition, the AIs were not found to relate significantly to this criterion; only the PAT related significantly to the criterion.

PREFACE

The research reported herein was conducted in support of the Force Acquisition and Distribution Systems thrust of the Air Force Human Resources Laboratory at Brooks AFB, Texas.

The authors wish to express their thanks to the several individuals who were connected with this effort over the several years of work it entailed. In particular, they wish to acknowledge the contributions of Major John Quebe and Dr. R. Bruce Gould, both of whom served, at one time or another, as the project manager for this research. Thanks are also due to the staff of the Air Traffic Control Operator School, Keesler AFB, Mississippi, for their efforts in support of the data collection.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

AIR TRAFFIC CONTROLLER TRAINEE SELECTION

I. INTRODUCTION

Air traffic controllers are employed in a variety of settings in the United States Air Force (USAF). Typically, USAF controllers include tower personnel, approach controllers, and area controllers. The Air Traffic Control Operator School at Keesler AFB, Mississippi, trains between 800 and 1,000 airmen each year to be air traffic controllers. During any given calendar year, the percentage of those entering training who do not complete training (the attrition rate) has been approximately 20%. Further, approximately 10% of those individuals graduating from air traffic controller training fail to obtain the necessary Federal Aviation Administration (FAA) certification for their specialty during their first-year assignment and are subsequently removed from the career field and scheduled for retraining.

The relatively high incidence of failures during training, coupled with later on-the-job attrition in a career field with a high flow rate, led to concern by the controlling agency (Air Force Communications Command) over the (then) current selection methods. Prior to 1983, air traffic controller trainees were selected based upon their scores on two Aptitude Indexes (AIs) from the Armed Services Vocational Aptitude Battery (ASVAB). Four AIs are available to the Air Force from the ASVAB for the selection and classification of enlisted personnel: (a) Mechanical, (b) Administrative, (c) General, and (d) Electronics. These AIs are weighted composites of certain subtests of the ASVAB. To be selected for air traffic controller training, an individual must have achieved a minimum score of 45 on the General AI or a minimum score of 50 on the Administrative AI.

The need to reexamine the existing selection procedures, with the goal of reducing the level of attrition, was documented in a Request for Personnel Research, RPR 78-13, Screening of Prospective Air Traffic Control Operators, sponsored by the Air Force Communications Command (HQ AFCC/ATC). This technical paper documents the work conducted by the Air Force Human Resources Laboratory (AFHRL) in support of RPR 78-13. It describes the results of analyses which reevaluated the utility of existing tests (the four ASVAB AIs) for selection of air traffic controller trainees, documents the development and evaluation of a battery of new tests targeted specifically for the selection of air traffic controllers, and describes the results of analyses which evaluated the utility of the new tests given independently of and in conjunction with the ASVAB. Also, the utility of the four ASVAB AIs and the new experimental battery in predicting first-year post-training attrition was ascertained.

II. BACKGROUND

As previously mentioned, there are three types of air traffic controller specialties (tower personnel, approach controllers, and area controllers) trained at Air Traffic Control Operator School. Tower personnel are responsible for the control of aircraft operating on, or in the immediate vicinity (approximately 5 miles) of, the airfield. They rely principally upon visual monitoring of the situation; however, some radar information is often available. Approach controllers are responsible for the control of aircraft as the aircraft transition from enroute flight to their approach to landing. These controllers may use Ground-Controlled Approach (GCA) radar systems to monitor the flight path and altitude of the aircraft under their control. Area controllers are responsible for aircraft enroute from one airfield to another. They ensure proper separation of aircraft operating under Instrument Flight Rules (IFRs) and monitor the position reports made by aircraft at mandatory reporting points. Area controllers rely heavily upon radar information. The air traffic controller specialties, then, depend upon visual and radar monitoring capabilities.

This effort, in addition to reevaluating the possible contributions of the ASVAB AIs as predictors of Air Traffic Control Operator School performance and first-year post-training attrition, also considered the use of new tests. Five tests were chosen to constitute a specialized air traffic controller experimental aptitude battery. These tests were: (a) Multiplex Controller Aptitude Test (MCAT), (b) Object Completion Test (OCT), (c) Rotated Blocks Test (RBT), (d) Perceptual Abilities Test (PAT), and (e) Electrical Maze Test (EMT). The first test, the MCAT, was selected based on previous research conducted by the FAA (developer of the MCAT) which indicated that the test might be valid for controller selection (Dailey & Pickrel, 1977). The remaining tests were selected based on other studies (Bartanowicz, 1979; Brokaw, 1979; Sells, Dailey, & Pickrel, 1984) that reported significant relationships between success in controller training and performance on tests of spatial ability, interviews with air traffic controllers and instructors who indicated such abilities were important in successful controller training, and communications with other researchers active in this field who described some of the tests currently under evaluation by other organizations.

III. PROCEDURE

This investigation employed a two-pronged approach. First, the utilities of the ASVAB AIs were reassessed to determine the validity of the four AIs for the prediction of air traffic controller training success. Secondly, a battery of new tests was assembled which could be given independently of or in conjunction with the ASVAB. The validities of those new tests were assessed both independently and in combination with the AIs from the ASVAB. The subjects, materials, and procedures used in each of these approaches will be described below.

Subjects

First, to reassess the validity of the four AIs for the prediction of air traffic controller training success, the historical personnel data bases resident at AFHRL, along with data supplied by the Air Traffic Control Operator School at Keesler AFB, were used to obtain multi-year samples of individuals who had attended air traffic controller training and had either graduated (passed the course) or been eliminated (failed the course). The reasons for being eliminated from the course included both not completing the course and unsuccessfully completing the course. A total of five samples of individuals who entered air traffic controller training from 1978 to 1981 were created. There were 883 subjects in Sample 1 from calendar year 1978. There were two samples of individuals created from calendar year 1979, with 296 subjects in Sample 2 and 563 subjects in Sample 3. For calendar year 1980, Sample 4 contained 911 individuals; and for calendar year 1981, Sample 5 contained 385 individuals. A total of 3,038 individuals from Samples 1 - 5 were used to reanalyze the utility of the ASVAB AIs in predicting air traffic controller training success.

Two samples were used for the second approach. One sample was used to determine suitable timing limits and obtain reliability estimates of the five new tests that composed the experimental aptitude battery. This sample, Sample 6, consisted of 778 basic airmen at Lackland AFB, Texas. The other sample, Sample 7, was used to assess the utility of the five new experimental tests both independently and in conjunction with the AIs from the ASVAB as predictors of Air Traffic Control Operator School performance and first-year post-training attrition. Sample 7 consisted of 457 air traffic controller trainees who were administered the ASVAB and the experimental aptitude battery prior to the start of training.

Materials

The following paragraphs describe (a) the ASVAB, the test currently used to select airmen for air traffic controller training, and (b) the five tests constituting the specialized air traffic controller experimental aptitude battery proposed to select airmen for training.

ASVAB. The ASVAB is a multiple-aptitude test battery designed to qualify individuals for entry into the Military Services and the Coast Guard and for assignment to military occupational training programs. This test is designed to measure potential for occupations that require formal courses of instruction or on-the-job training. In addition, the ASVAB provides measures of general ability that are useful in predicting performance in academic areas.

Multiplex Controller Aptitude Test (MCAT). Selection of the MCAT for inclusion in the experimental battery was based upon the recommendations of Dr. Evan Pickrel (personal communication) of the FAA. The MCAT is a job-sample measure in which the examinee is given a lengthy explanation regarding the interpretation of a paper-and-pencil depiction of an area radar display--an air-route structure resembling a rectangle with spokes running from each of the four corners to the edge of the simulated display. Each of the endpoints of the air-routes, along with the four intersections (corners of the rectangle), are lettered. Several aircraft are also depicted at various locations along the air-routes. For each test item, the altitude, airspeed and routing of each aircraft are given. For a typical item, the examinee must decide if a conflict (i.e., two aircraft occupying the same altitude and passing the same point at the same time) will occur. In the original version of the test, as developed by the FAA, the structure of the test and the ordering of the items was controlled so as to result in a slowly increasing level of difficulty. Because of time limitations, a modified, and significantly shortened version was administered to the Air Force samples. There were 30 items in this version of the MCAT.

Object Completion Test (OCT). The OCT is a test of an individual's ability to recognize an object when some of its parts have been removed. There were 20 items in this test. The OCT and the following tests were selected because of previous research that had demonstrated significant relationships between tests of perceptual and spatial abilities and controller training performance.

Rotated Blocks Test (RBT). In the RBT, the examinee is shown a drawing of a three-dimensional block. The examinee must then choose from among five other drawings the one that is the same as the first block, as seen from a different perspective. Previous research has established this test as a definitive measure of spatial ability. There were 20 items in this test.

Perceptual Abilities Test (PAT). In this test, the examinee is shown several lettered dots and one dot with a circle around it. Between the dots, various smooth or irregular lines may appear. The examinee must decide which of the lettered dots is closest to the circled dot. There were 20 items in this test.

Electrical Maze Test (EMT). The EMT is a test of the examinee's ability to choose a correct path from among several choices. The examinee is shown a box with dots marked S and F; S is the starting point, and F is the finishing point. The examinee must follow the line from S, through a circle at the top of the picture, and back to F. In each item, there were five such boxes, only one of which had a line which led from the S, through the circle, and back to the F in the same box. Interconnections between lines were indicated by dots. There were 20 items in this test.

The entire set of five experimental tests (MCAT, OCT, RBT, PAT, and EMT) were printed by AFHRL in a single experimental RESEARCH CONTROLLED test booklet entitled Air Traffic Controller Experimental Aptitude Battery (MO 81-63). A copy of the booklet is contained in the AFHRL Manpower and Personnel Division's test reference file.

Procedure

For the approximately 3,000 basic airmen in Samples 1-5, ASVAB AI scores and an indication of training success (whether the air traffic controller course was passed or failed) were obtained. Recall that failure was due either to non-completion of the course or unsuccessfully completing the course. For each sample, correlation coefficients between the four ASVAB AIs and the dichotomous pass/fail criterion were computed to determine the degree of relationship between each ASVAB AI and training performance, and the consistency of the relationship across time.

To determine suitable timing limits and obtain reliability estimates of the five experimental tests, the five separately timed tests comprising the experimental aptitude battery were administered to the 778 basic airmen in Sample 6.

Finally, to assess the utility of the five experimental tests as selectors for air traffic controller training performance, the experimental aptitude battery was administered to the 457 airmen in Sample 7 prior to the start of air traffic controller training. Once experimental aptitude test scores were obtained for these airmen, ASVAB AI scores were obtained from the historical personnel data files resident at AFHRL. Both ASVAB AI and experimental aptitude test scores were available for 385 of the 457 airmen. ASVAB AI and experimental test scores were compared with later training performance (whether the course was passed or failed). Correlation coefficients between the five experimental tests and the pass/fail criterion were computed to determine the degree of relationship between each experimental test and training performance. Multiple regression analyses which combined the ASVAB AIs with the new tests were also performed. In addition to the prediction of air traffic controller training success, the prediction of first-year post-training attrition was also addressed.

IV. RESULTS AND DISCUSSION

The results of the analyses to reevaluate the validities of the existing ASVAB AIs for the selection of air traffic controller trainees are shown in Table 1, which presents the correlation coefficients between the ASVAB AIs and a dichotomous pass/fail criterion for each of five samples of individuals who entered air traffic controller training from 1978 to 1981. All of these correlations were statistically significant; that is, it is very unlikely that the true correlations are zero and that the observed correlations arose simply by chance. These correlations exhibited a consistent pattern across the samples. Further inspection of these correlations showed that the General, Mechanical, and Electronics AIs had consistent, approximately equivalent, relationships to training performance, whereas the Administrative AI had a considerably lower relationship with the criterion. At the time the individuals in the samples entered training, selection was based upon either the General or the Administrative AI. This selection may have resulted in an attenuation (lowering) of the observed correlations for the AI used for selection, because those individuals with low scores were not admitted to training. An inspection of the range of scores on both the General (Figure 1) and Administrative (Figure 2) AIs indicated that this restriction-of-range phenomenon did occur. This was possible because of the selection requirement; i.e., a minimum score of 45 on the General AI or a minimum score of 50 on the Administrative AI. Thus, the range of scores on the General AI was curtailed more severely than was the score range on the Administrative AI. Application of a statistical procedure to estimate the true (unrestricted) correlation (Guilford & Fruchter, 1973, p. 315)

between the General AI and the pass/fail criterion for the various samples produced estimates which are given in parentheses in Table 1.

Table 1. Correlation Coefficients of ASVAB Aptitude Indexes with Air Traffic Controller Training Performance (Pass/Fail) (Samples 1 - 5)

Samples	N	ASVAB aptitude indexes			
		General[a]	Administrative	Mechanical	Electronics
1 - CY1978	883	.20**(.30)	.14**	.33**	.30**
2 - CY1979A	296	.26**(.37)	.14*	.24**	.26**
3 - CY1979B	563	.31**(.40)	.15**	.22**	.29**
4 - CY1980	911	.21**(.28)	.11**	.23**	.23**
5 - CY1981	385	.19**(.24)	.11**	.24**	.25**

[a]Corrected for restriction of range.

*$p \leq .05$.

**$p \leq .01$.

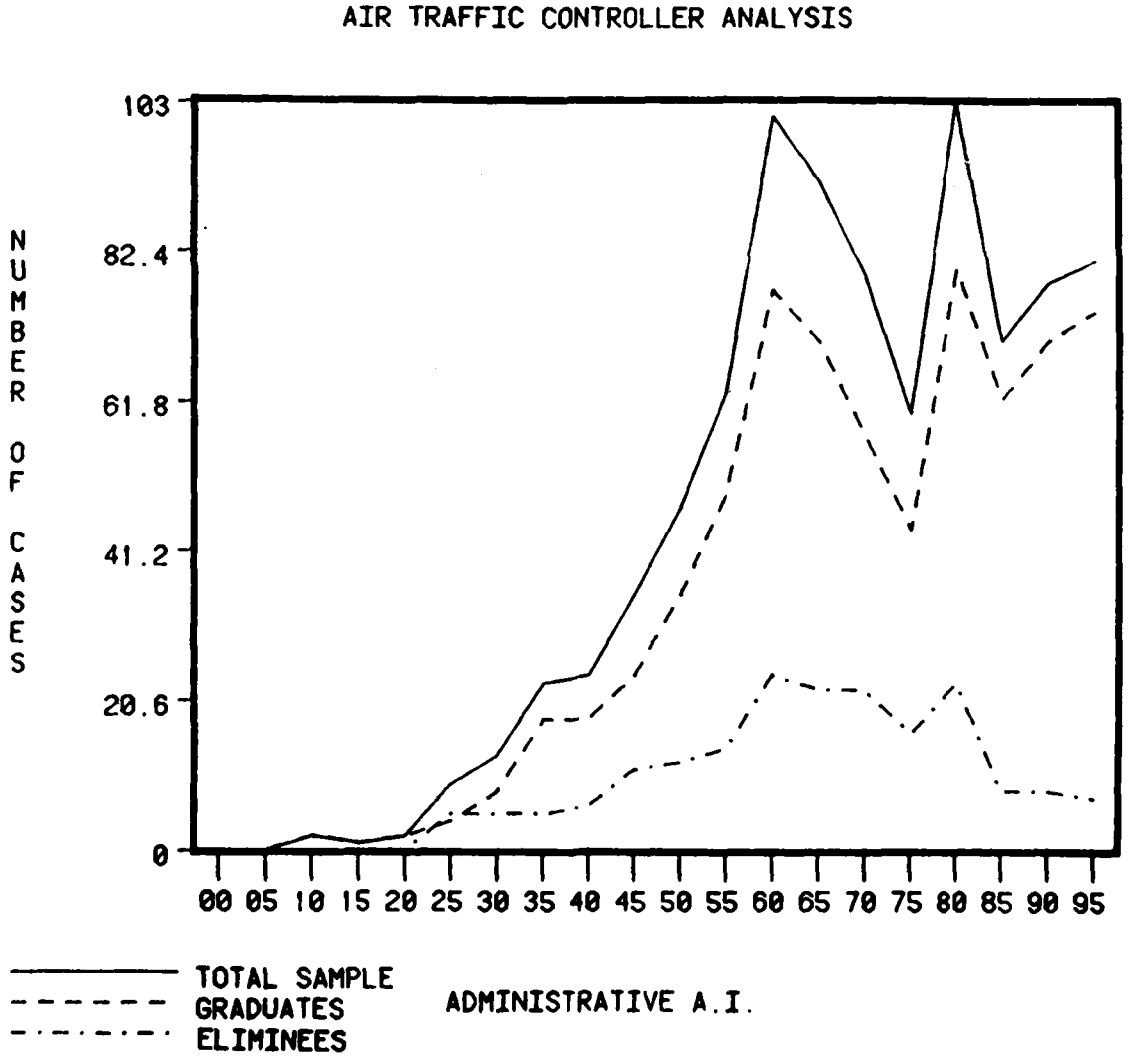


Figure 1. Distribution of ASVAB Administrative AI Scores.

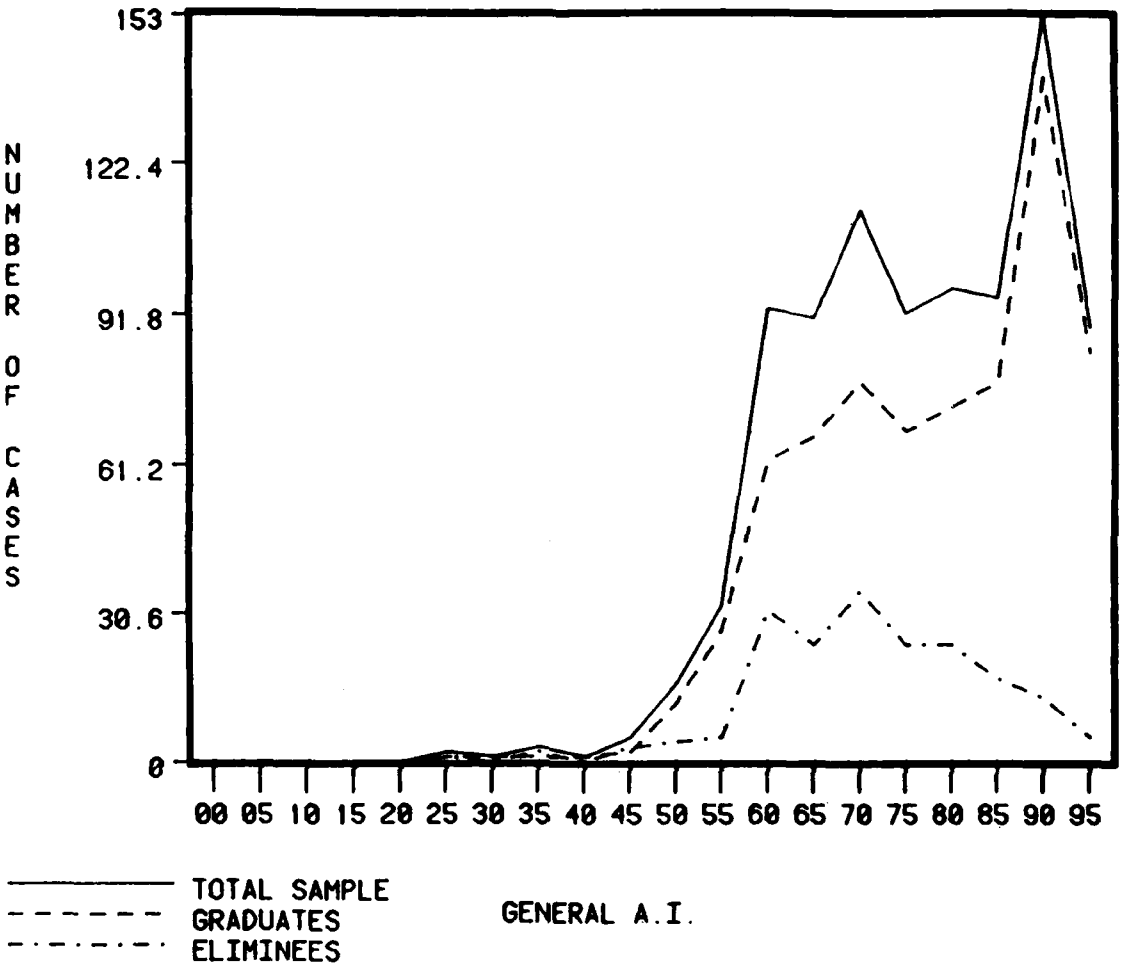


Figure 2. **Distribution of ASVAB General AI Scores.**

When the experimental aptitude battery was administered to Sample 6 airmen to determine suitable timing limits and obtain reliability estimates, the tests were separately timed, and required approximately 2 hours for completion of the entire battery. The reliability coefficients (KR Formula 20) obtained from Sample 6 are presented in Table 2. These coefficients ranged from .70 for OCT to .87 for EMT and were all within the range generally considered adequate for experimental tests. Operational use, however, might dictate that the tests all be lengthened somewhat to improve reliability.

Table 2. **Reliability of Tests Comprising the Experimental Aptitude Battery (Sample 6; N = 778)**

Test	Reliability
Multiplex Controller Aptitude Test (MCAT)	.73
Object Completion Test (OCT)	.70
Rotated Blocks Test (RBT)	.77
Perceptual Abilities Test (PAT)	.75
Electrical Maze Test (EMT)	.87

In assessing the predictive validity of the five new experimental tests, both independently and in conjunction with the AIs from the ASVAB, the validity of the experimental tests in predicting training performance and in predicting later on-the-job attrition was of interest. Table 3 shows the results for each of the five experimental tests administered to Sample 7 airmen prior to entry into controller training: the means and standard deviations of the total group; the graduates, those individuals who successfully completed training; and the failures, those who did not complete training or unsuccessfully completed training. The mean of the scores for each experimental aptitude test was found to be higher for the graduates than for the failures. In Table 4, the intercorrelations among the five tests, along with the correlation coefficients of each test with the dichotomous pass/fail criterion, are presented. With the exception of the PAT, all of the tests were significantly correlated with training performance.

Table 3. Means and Standard Deviations of Training Graduates, Failures, and Total for Tests Comprising the Experimental Aptitude Battery (Sample 7; N = 457)

	Graduates N = 394		Eliminees N = 63		Total N = 457	
Test	Mean	SD	Mean	SD	Mean	SD
MCAT	15.73	3.97	13.10	4.05	15.37	4.09
OCT	10.78	3.17	9.60	3.04	10.62	3.18
RBT	6.70	3.70	4.27	3.27	6.36	3.74
PAT	14.10	3.12	13.43	3.16	14.01	3.13
EMT	15.46	4.50	13.54	4.81	15.19	4.60

Table 4. Intercorrelations of Experimental Aptitude Battery Tests and Validity Coefficients (Sample 7; N = 457)

Test	MCAT	OCT	RBT	PAT	EMT	Criterion (Pass/Fail)
MCAT	1.00	.39	.48	.26	.50	.22**
OCT		1.00	.34	.22	.39	.13**
RBT			1.00	.26	.49	.22**
PAT				1.00	.29	.07^{ns}
EMT					1.00	.14**
Criterion						1.00

^{ns}Not Significant.

**$p \leq .01$.

The correlation coefficients of the five experimental tests with the AIs from the ASVAB are given in Table 5. The sample used for the computation of these intercorrelations was a subset (N = 385) of those appearing in Table 4, for whom valid ASVAB scores were available. In general, the four ASVAB AIs correlated the highest with the MCAT.

For the subset of Sample 7 (N = 385) that had matching ASVAB AI and experimental aptitude test scores, the relationships between ASVAB AIs and experimental tests and training performance (pass/fail) were assessed. Recall that it was found that the General AI, Mechanical AI, and Electronics AI correlated well with training performance, but the Administrative AI showed a smaller relationship with the criterion. These results are illustrated in Table 6, which

compares training graduates and eliminees. Although graduates and eliminees differed significantly on all four of the ASVAB AIs, the magnitude of the differences was much greater for the Electronics, General, and Mechanical AIs than for the Administrative AI. Of the five experimental tests, all except one (PAT) showed significant differences between the graduates and eliminees.

Table 5. Correlation Coefficients of ASVAB Aptitude Indexes and Experimental Aptitude Battery (Sample 7; N = 385)

	ASVAB aptitude indexes			
Test	Mechanical	Administrative	General	Electronics
MCAT	.46	.30	.39	.51
OCT	.33	.12	.30	.35
RBT	.47	.08	.29	.46
PAT	.21	.18	.19	.28
EMT	.48	.12	.29	.49

Table 6. Comparisons of Training Graduates and Eliminees on ASVAB AIs and Experimental Tests

	Total sample N = 385		Graduates N = 333		Eliminees N = 52		
	Mean	SD	Mean	SD	Mean	SD	Z Test+
ASVAB							
Administrative	64.22	19.03	65.06	18.98	58.85	18.65	2.23*
Electronics	62.60	18.23	64.40	17.90	51.06	16.13	5.46**
General	67.55	15.50	68.99	15.51	58.27	11.88	5.81**
Mechanical	53.00	22.81	54.73	22.83	41.92	19.48	4.30**
Experimental Battery							
MCAT	15.34	4.08	15.66	3.99	13.29	4.09	3.90**
OCT	10.41	3.20	10.59	3.17	9.25	3.18	2.83**
RBT	6.30	3.77	6.61	3.74	4.33	3.39	4.45**
PAT	13.96	3.15	14.03	3.16	13.46	3.03	1.25
EMT	15.06	4.66	15.30	4.57	13.56	4.96	2.38*

*$p \leq .05$.
**$p \leq .01$.
+Comparison of Training Graduates and Eliminees.

Table 7 presents multiple regression models computed using the ASVAB AIs and the new experimental tests. A comparison of Model 1 and Model 2 shows that only two of the five tests (MCAT and RBT) contributed to the prediction of the training criterion (pass/fail). Hence, the subsequent models used only the MCAT and RBT from the experimental battery. It is apparent from the comparisons performed among these models that both the ASVAB AIs and the two tests selected from the experimental aptitude battery (MCAT and RBT) make significant, and to some degree independent, contributions to the prediction of the pass/fail criterion.

Table 7. Multiple Regression Models

Model no.	Criterion	Predictors	No. of predictors	N	R^2
1	Pass/Fail	MCAT, RBT, OCT, PAT, EMT	5	457	.069
2	Pass/Fail	MCAT, RBT	2	457	.068
3	Pass/Fail	M, A, G, E, MCAT, RBT	6	385	.084
4	Pass/Fail	MCAT, RBT	2	385	.056
5	Pass/Fail	M, A, G, E	4	385	.028

Model Comparisons

Model 3 versus Model 4 $F = 2.84$ $df_1 = 4$ $df_2 = 378$ $p \leq .05$
Null Hypothesis: MCAT and RBT make no contribution to ASVAB.

Model 3 versus Model 5 $F = 11.54$ $df_1 = 2$ $df_2 = 378$ $p \leq .01$
Null Hypothesis: M, A, G, E Aptitude Indexes make no contribution to MCAT and RBT.

In addition to the prediction of training performance, the second part of this effort also addressed the prediction of first-year post-training attrition. Table 8 compares the performance of first-year post-training successes and failures (all reasons) for the sample of individuals who took the experimental test battery. Though there was a tendency for the successes to score higher on the ASVAB AIs, in no case was the difference between the two groups statistically significant. Of the five tests in the experimental battery, in only one case (PAT) was there a significant difference between the scores of the successes and failures. Interestingly, the PAT, which discriminated reliably between first-year post-training successes and failures was the only experimental test that was not predictive of training performance. This suggests that the abilities or skills related to first-year post-training success may not be the same as those related to success in training. This also implies that the training course may not address all of the tasks which controllers perform on the job.

Table 8. Comparisons of First-Year Post-Training Successes and Failures on ASVAB AIs and Experimental Tests

	Training graduates N = 333		Field successes N = 295		Field failures N = 38		
	Mean	SD	Mean	SD	Mean	SD	Z Test[a]
ASVAB							
Administrative	65.06	18.98	65.54	18.97	61.32	18.84	1.30
Electronics	64.40	17.90	64.88	18.08	60.66	16.36	1.48
General	68.99	15.51	69.54	15.61	64.74	14.14	1.94
Mechanical	54.73	22.83	54.93	22.74	53.16	23.78	0.43
Experimental Battery							
MCAT	15.66	3.99	15.78	3.98	14.76	4.00	1.48
OCT	10.59	3.17	10.60	3.06	10.53	3.96	0.10
RBT	6.61	3.74	6.65	3.73	6.26	3.86	0.59
PAT	14.03	3.16	14.18	3.07	12.87	3.63	2.13*
EMT	15.30	4.57	15.33	4.50	15.03	5.17	0.31

[a]Comparison of Field Successes and Field Failures.
*$p \leq .05$.

V. CONCLUSIONS AND RECOMMENDATIONS

The results of this effort have consistently demonstrated the lack of an adequate relationship between the Administrative AI from the ASVAB and later performance in air traffic controller training, and the consistently superior utility of the General AI. The conclusions of this aspect of the research and their implications for the selection of air traffic controller trainees appear evident: Use of the Administrative AI as a selector should be discontinued. Such a recommendation was made as an interim report to the requesting agency (AFCC) and subsequently implemented in Air Force Regulation 39-1. Henceforth, the sole selection requirement for entry into the air traffic controller training is a minimum score of 45 on the General AI. The elimination of entry into air traffic controller training based upon the Administrative AI, combined with an appropriate minimum score requirement on the General AI, should result in a reduction in training school attrition.

The research accomplished has further demonstrated potentially useful relationships between tests not currently in the ASVAB and air traffic controller training performance. In particular, the MCAT, with its job-sample approach, has been shown to be a valid predictor of later training performance. This test, along with the RBT, could make a significant contribution to the ASVAB AI in the prediction of controller training performance. Although the administrative requirements of conducting a nation-wide recruit testing program might preclude the implementation of specialized tests of this sort for individual career fields at this time, their possible contributions may be realized at some future date. Implementation of computer adaptive testing (CAT) may well provide a vehicle for the easy implementation of an array of specialized tests for the selection of individuals for particular career fields, in addition to the administration of the multi-Service ASVAB. With full-scale implementation of CAT, these tests, already proven valid, could be placed in service with a minimum of delay.

With one exception, the measures examined in the present effort were shown to be incapable of reliably predicting first-year post-training attrition. A close examination of the air traffic controller training syllabus and its relationship to post-training job requirements may be warranted.

REFERENCES

Air Force Regulation 39-1. (1982, January). Airman classification. Washington, DC: Department of the Air Force.

Bartanowicz, R. S. (1979). The Armed Services Vocational Aptitude Battery and the Federal Aviation Administration's controller decision evaluation and multiplex controller aptitude tests as predictors of success in the USAF air traffic control field (Student Research Report 0135-79). Keesler AFB, MS: Air Command and Staff College.

Brokaw, L. D. (1979). Historic overview of research and development for air traffic controller selection. Paper presented at the meeting of the Military Testing Association, San Diego, CA.

Dailey, J. T., & Pickrel, E. W. (1977). Development of new selection tests for air traffic controllers (FAA-AM-77-25). Washington, DC: Federal Aviation Administration.

Guilford, J. P., & Fruchter, B. (1973). Fundamental statistics in psychology and education. New York: McGraw-Hill.

Sells, S. B., Dailey, J. T., & Pickrel, E. W. (1984). Selection of air traffic controllers (Report No. FAA-AM-84-2). Washington, DC: Federal Aviation Administration.

END

FEB.

1988

DTIC